IV. REMARKS

1. Claims 19, 35, 41 and 43 are amended.

2. The specification is amended as described herein to move a portion of the "BACKGROUND OF THE INVENTION," which pertains to aspects of the instant invention into the "DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS."

3. Claims 19-20, 22-24, 27-30 and 47 are patentable under 35 U.S.C. 103(a) over Amateau et al. (US 5451275, hereinafter "Amateau") and Ladousse et al. (US 6729171, hereinafter "Ladousse"). Claim 19 recites the outer peripheral powder metal gear tooth finishing surface [of the die] being configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing. These features are not disclosed or suggested by the combination of Amateau and Ladousse.

The Examiner admits that Amateau does not disclose the workpiece is a powder metal workpiece but asserts the limitation of "rolling to a shape from tooth tip to tooth root on both sides of the gear tooth so that the tooth has desired dimensional tolerances for power transmission gearing are met" because Amateau discloses that "the gear can meet the dimensional tolerances of AGMA required for high performance gears without the necessity of grinding." However, on page 4 of the office action dated June 5, 2008 the Examiner admits that "[o]ne of ordinary skill in the art will readily appreciate that the dies used for roll finishing a wrought gear blank, as taught by

Amateau cannot be used to finish a powder metal gear blank of similar size due to the difference in density of materials." Thus, by the Examiner's own admission, Amateau cannot be relied on for rejecting the above-noted features of Applicant's claims. Combining Amateau with Ladousse fails to remedy this deficiency.

Ladousse appears to be silent as to the outer peripheral powder metal gear tooth finishing surface [of the die] being configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing. All that is disclosed in Ladousse is that "[i]n this final sizing phase (c), the blank/tool relative position is kept roughly constant for a chosen length of time defined to obtain a part of acceptable geometry, particularly of accepted roundness." The only geometric features disclosed as being "final sized" in Ladousse are the roundness and diameter of the part. (see e.g. Col. 11, L. 47-59; Col. 14, L. 43-47). However, it is noted that the final sizing is only an intermediary step in the forming process as Ladousse specifically recites that "the part in its entirety should withstand the total force that the tools impart on it, until a final part is obtained that meets the desired geometric and structural criteria <u>for this stage of its manufacture</u>" (Col. 6, L. 60-65). For example, Ladousse describes nothing more than a method of controlled load application for cold forming a blank made of press sintered material <u>prior to heat treatment</u> (See page 2, item 3 of the Affidavit from Dr. Nagesh Sonti dated May 13, 2009 and submitted herewith as "Appendix A", hereinafter "the Affidavit"). Thus, Ladousse merely discloses a pre-finishing technique for shaping press

sintered blanks such as gear blanks. Further heat treatment and finishing of the press sintered gear blanks, in either the as-sintered condition or after surface densification as described in Ladousse, is required to achieve the specified surface hardness, hardness gradient and core strength necessary for high load bearing capability, and to achieve the high accuracy needed for improved performance. (See the Affidavit at page 2, item 4).

With respect to forming gear teeth, Ladousse merely discloses that the blank may be preformed, particularly with teeth, in which case, the tool or tools are equipped with homologous teeth and nothing more (Col. 11, L. 67-Col. 12, L. 2). It is noted that in responding to Applicant's prior arguments the Examiner argues that Ladousse does not provide a definition of "homologous teeth." Accordingly, because Ladousse does not provide a definition of the term "homologous teeth" it is the ordinary meaning of the words that control (see e.g. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1318 (Fed. Cir. 2005)). As described in Applicant's prior response the word homologous is defined as "having the same relative position, value or structure" (see http://www.merriam-webster.com/dictionary/homologous, attached hereto as "Appendix B"). There appears to be absolutely no disclosure whatsoever in Ladousse of geometrically finishing a powder metal gear tooth "from tooth tip to tooth root on both sides of the gear tooth," so that the "geometrically finished tooth" "has dimensional tolerances for power transmission gearing" as Ladousse only discloses a pre-finishing technique for shaping press sintered blanks. Rather, after the rolling process, the gears formed by the method of Ladousse have to be case hardened by, for example, carburizing and hardening operations. Case hardening heat treatment inherently results in substantial distortion of the gear and gear teeth. Therefore,

substantial losses result in the accuracy and surface finish that was previously induced by the pre-finishing method described in Ladousse, thereby negating the intent of Ladousse when obtaining "a part of acceptable geometry" as described at column 11, lines 56-59 of Ladousse. (See the Affidavit at page 2, item 5). Because of the substantial distortion of, for example, the gear teeth from the hardening operations described above, the sintered and densified powder metal gears, as produced by the method of Ladousse, require substantial hard finishing by, for example, grinding, skiving, burnishing, or honing operations to achieve the required level of dimensional accuracy and performance. These subsequent finishing processes result in removal of about 150 microns of the previously densified surface region of, for example, the gear teeth described in Ladousse. Removal of a portion of the previously densified region of the surface layers of about 150 microns thereby lowers the load bearing capacity of the teeth because part of the surface region with densified surface layers, achieved using the method as described in Ladousse and followed by heat treatment, is removed. (See the Affidavit at page 2-3, item 6). At best all that Ladousse can reasonably be considered as disclosing is a reduction in diameter at the root of a tooth and nothing more (see e.g. Col. 15, L. 20-37). As described above, the gears produced by the method of Ladousse are in a pre-finished state and cannot be used as power transmission gears that required a high level of accuracy and surface finish for adequate performance unless some post hardening finishing operation such as grinding is applied. (See the Affidavit at page 3, item 7).

Thus, claim 19 is patentable at least for the reason that the combination of Amateau and Ladousse does not disclose or suggest the outer peripheral powder metal gear tooth finishing surface

[of the die] being configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing. It is also noted that contrary to the method described in Ladousse, the method described in the present application results in finished powder metal gear wheels with high hardness, strength, accuracy, surface finish and densified surface layers that do not require any further post hardening operations. (See the Affidavit at page 3, item 8).

Claim 19 also recites each die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry, the outer peripheral powder metal gear tooth finishing surface being configured to geometrically finish the powder metal surface of each tooth. These features are not disclosed or suggested by the combination of Amateau and Ladousse.

The Examiner admits that Amateau does not describe the dies having a powder metal gear tooth finishing surface configured to finish the powder metal surface of each tooth during rolling (see page 4 of the office action dated February 17, 2009). Thus, Amateau cannot disclose each die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry, the outer peripheral powder metal gear tooth finishing surface being configured to geometrically finish the powder metal surface of each tooth. Combining Amateau with Ladousse fails to remedy this deficiency.

All that is disclosed in Ladousse is that the tool or tools are equipped with homologous teeth and nothing more (Col. 12, L. 1-2). Again, it is noted that in responding to Applicant's prior arguments the Examiner argues that Ladousse does not provide a definition of "homologous teeth." Accordingly, because Ladousse does not provide a definition of the term "homologous teeth" it is the ordinary meaning of the words that control (see e.g. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1318 (Fed. Cir. 2005)). As described in Applicant's prior response the word homologous is defined as "having the same relative position, value or structure" (see http://www.merriam-webster.com/dictionary/homologous). Therefore, all that can be ascertained from Ladousse is that the teeth of the dies in Ladousse are the same as the teeth of the work piece. Thus, Ladousse cannot disclose or suggest each die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal tooth geometry of the gear teeth, the outer peripheral powder metal gear tooth finishing surface being configured to geometrically finish the powder metal surface of each tooth.

Thus, claim 19 is patentable over the combination of Amateau and Ladousse for the additional reason that Amateau and Ladousse do not disclose or suggest each die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry, the outer peripheral powder metal gear tooth finishing surface being configured to geometrically finish the powder metal surface of each tooth.

Claims 20, 22-24, 27-30 and 47 depend from claim 19 and are patentable at least by reason of their respective dependencies.

4. Claims 25 and 26 are patentable under 35 U.S.C. 103(a) over Amateau, Ladousse and "Applicant's Admitted Prior Art". It is submitted that because Amateau and Ladousse do not disclose or suggest all the features of Applicant's claim 19 (from which claims 25 and 26 depend) that the combination of Amateau, Ladousse and "Applicant's Admitted Prior Art" cannot as well. Thus claims 25 and 26 are patentable at least by reason of their respective dependencies.

5. Claims 31 and 32 are patentable under 35 U.S.C. 103(a) over Amateau, Ladousse and Torii et al. (US 4972735, hereinafter Torii). It is submitted that because Amateau and Ladousse do not disclose or suggest all the features of Applicant's claim 19 (from which claims 31 and 32 depend) that the combination of Amateau, Ladousse and Torii cannot as well. Thus claims 25 and 26 are patentable at least by reason of their respective dependencies.

6. Claims 35, 37-39 and 41-46 are patentable under 35 USC 103(a) over Sonti et al. (US 6779270, hereinafter "Sonti") and Ladousse. Claim 35 recites the rolling die having an outer peripheral powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing. These features are not disclosed or suggested by the combination of Sonti and Ladousse.

The Examiner asserts that geometrically finishing the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically

finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing is disclosed in Sonti because Sonti discloses that "the gear can meet the dimensional tolerances of AGMA required for high performance gears" (Col. 5, l. 4-11). This assertion is unreasonable because, as admitted by the Examiner, Sonti does not describe that the dies have a powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth during rolling. Thus, because Sonti does not disclose dies having a powder metal finishing surface as claimed by Applicant it follows that Sonti cannot reasonably be relied on to reject the feature of geometrically finishing the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing as recited by Applicant. Combining Sonti with Ladousse fails to remedy this deficiency.

Ladousse merely discloses that the tool or tools are equipped with homologous teeth and nothing more (Col. 12, L. 1-2). As noted above, because Ladousse does not provide a definition of "homologous teeth," it is the ordinary meaning of these words that control (see e.g. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1318 (Fed. Cir. 2005)). As described in Applicant's prior response the word homologous is defined as "having the same relative position, value or structure" (see http://www.merriam-webster.com/dictionary/homologous). Thus Ladousse cannot disclose or suggest the rolling die having an outer peripheral powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during

rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing.

Thus, claim 35 is patentable over the combination of Sonti and Ladousse at least for the reason that their combination does not disclose or suggest the rolling die having an outer peripheral powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing.

Further, claim 35 recites that the geometrically finished tooth has dimensional tolerances for power transmission gearing without subsequent grinding of the powder metal surface of the gear tooth. This feature is not disclosed or suggested by the combination of Sonti and Ladousse.

As described above, and as admitted by the Examiner, Sonti does not disclose a powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth during rolling. The Examiner also admits that Sonti does not disclose a powder metal gear blank. Thus, Sonti cannot reasonably be considered as disclosing the geometrically finished [powder metal] tooth has dimensional tolerances for power transmission gearing without subsequent grinding of the powder metal surface of the gear tooth. Combining Sonti with Ladousse fails to remedy this deficiency.

As described above, Ladousse describes a pre-finishing rolling technique for powder metal gears. (See the Affidavit at page 2,

items 3-4). For example, after the rolling process, the gears formed by the method of Ladousse have to be case hardened by, for example, carburizing and hardening operations. Case hardening heat treatment inherently results in substantial distortion of the gear and gear teeth. Therefore, substantial losses result in the accuracy and surface finish that was previously induced by the pre-finishing method described in Ladousse, thereby negating the intent of Ladousse when obtaining "a part of acceptable geometry" as described at column 11, lines 56-59 of Ladousse. (See the Affidavit at page 2, item 5). Because of the substantial distortion of, for example, the gear teeth from the hardening operations described above, the sintered and densified powder metal gears, as produced by the method of Ladousse, require substantial hard finishing by, for example, grinding, skiving, burnishing, or honing operations to achieve the required level of dimensional accuracy and performance. These subsequent finishing processes result in removal of about 150 microns of the previously densified surface region of, for example, the gear teeth described in Ladousse. Removal of a portion of the previously densified region of the surface layers of about 150 microns thereby lowers the load bearing capacity of the teeth because part of the surface region with densified surface layers, achieved using the method as described in Ladousse and followed by heat treatment, is removed. (See the Affidavit at page 2-3, item 6). At best all that Ladousse can reasonably be considered as disclosing is a reduction in diameter at the root of a tooth and nothing more (see e.g. Col. 15, L. 20-37). As described above, the gears produced by the method of Ladousse are in a pre-finished state and cannot be used as power transmission gears that required a high level of accuracy and surface finish for adequate performance unless some post hardening finishing

operation such as grinding is applied. (See the Affidavit at page 3, item 7).

Therefore, Ladousse cannot disclose or suggest the geometrically finished tooth has dimensional tolerances for power transmission gearing without subsequent grinding of the powder metal surface of the gear tooth.

Thus, claim 35 is patentable for the additional reason that the combination of Sonti and Ladousse does not disclose or suggest that the geometrically finished tooth has dimensional tolerances for power transmission gearing without subsequent grinding of the powder metal surface of the gear tooth. This argument applies equally to claim 43.

Claim 41 recites the rolling die having an outer peripheral powder metal gear tooth finishing surface configured to geometrically finish the powder metal surface of each tooth, from tooth tip to tooth root on both sides of the gear tooth, during rolling so that the geometrically finished tooth, from tooth tip to tooth root on both sides of the gear tooth, has dimensional tolerances for power transmission gearing. This feature of claim 41 is patentable over the combination of Sonti and Ladousse for reasons that are substantially similar to those described above with respect to claim 35.

Claim 41 also recites that the rolling die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry. This feature is not disclosed or suggested by the combination of Sonti and Ladousse.

As admitted by the Examiner Sonti does not describe that the dies have a powder metal gear tooth finishing surface configured to

geometrically finish the powder metal surface of each tooth during rolling. Thus, one cannot reasonably consider Sonti as disclosing the rolling die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal tooth geometry of the [powder metal] gear teeth. Combining Sonti with Ladousse fails to remedy this deficiency.

As described above, all that is disclosed in Ladousse is that the tool or tools are equipped with homologous teeth and nothing more (Col. 12, L. 1-2). Thus, Ladousse cannot disclose or suggest each die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry, the outer peripheral powder metal gear tooth finishing surface being configured to geometrically finish the powder metal surface of each tooth.

Thus, claim 41 is patentable over the combination of Sonti and Ladousse for the additional reason that their combination does not disclose or suggest the rolling die having an outer peripheral powder metal gear tooth finishing surface that substantially deviates from a nominal involute tooth geometry.

Claims 37-39, 42 and 44-46 depend from claims 35, 41 and 43 and are therefore patentable at least by reason of their respective dependencies.

Applicant respectfully requests a telephone interview with the Examiner after the Examiner has reviewed Applicant's response and before issuance of the next office action.

The Commissioner is hereby authorized to charge payment for one additional dependent claim and any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,

5-14-2009

William J. Knotts, Jr.
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Shauna Murphy

Person Making Deposit

APPENDIX A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(s):	Sonti, et al.	CONF. NO.:	3267
SERIAL NO.:	10/802,141	ART UNIT:	1793
FILING DATE:	03/17/2004	EXAMINER:	Kessler, Christopher S.
TITLE:	METHOD AND APPARATUS FOR STRENGTHENING OF POWDER METAL GEARS BY AUSFORMING		
ATTORNEY DOCKET NO.:	215P011709-US (PAR)		

Declaration Under 37 C.F.R. 1.132

I, Dr. Nagesh Sonti being as listed an inventor in the subject patent application do hereby state that:

1. I, Nagesh Sonti, have over twenty one years of experience in the design and production of gears. In addition, I have over thirty three years of experience in thermal-mechanical processing of steels, including heat treatment, joining, machining and finishing of steel components. I am presently a Senior Research Engineer at the Applied Research Lab at Pennsylvania State University. I have a Ph.D. in Engineering Science and Mechanics from Pennsylvania State University, a Masters degree in Welding Engineering from Ohio State University and a Bachelors degree in Mechanical Engineering from the University of Madras, India.

2. I have thoroughly reviewed the cited reference Ladousse et al. (U.S. Pat. No. 6729171, hereinafter "Ladousse").

3. Ladousse describes a method of controlled load application for cold forming a blank made of press sintered material prior to heat treatment. The method includes moving at least one tool towards the blank and subjecting the blank to rolling under a roughly constant load for a number of passes until the at least one tool reaches a chosen position. One or more of the chosen position of the tool, the roughly constant load and the number of passes is determined so as to control a surface densification and at least one dimension of the rolled blank.

4. Ladousse provides a pre-finishing technique for shaping press sintered blanks such as gear blanks. Further heat treatment and finishing of the press sintered gear blanks, in either the as-sintered condition or after surface densification as described in Ladousse, is required to achieve the specified surface hardness, hardness gradient and core strength necessary for high load bearing capability, and to achieve the high accuracy needed for improved performance.

5. After the rolling process, the gears formed by the method of Ladousse have to be case hardened by carburizing and hardening operations. Case hardening heat treatment inherently results in substantial distortion of the gear and gear teeth. Therefore, substantial losses result in the accuracy and surface finish that was previously induced by prefinishing using the method described in Ladousse thereby negating the intent of Ladousse when obtaining "a part of acceptable geometry" as described at column 11, lines 56-59 of Ladousse.

6. Because of the substantial distortion of, for example, the gear teeth from the hardening operations, the sintered and densified powder metal gears, as produced by the method of Ladousse, require subsequent hard finishing by grinding,

skiving, burnishing, or honing operations to achieve the enhanced level of dimensional accuracy and performance. These subsequent finishing processes result in removal of about 150 microns of the previously densified surface region of, for example, the gear teeth described in Ladousse. Removal of a portion of the previously densified region of the surface layers of about 150 microns thereby lowers the load bearing capacity of the teeth because part of the surface region with densified surface layers, achieved using the method as described in Ladousse and followed by heat treatment, is removed.

7. Gears produced by the method described in Ladousse and then case hardened cannot be used as power transmission gearing that require a high level of accuracy and surface finish for enhanced performance unless some post hardening finishing operation such as grinding is applied.

8. In contrast to the method described in Ladousse, the method described in the present application results in finished powder metal gear wheels with high hardness, strength, accuracy, surface finish and densified surface layers that do not require any further post hardening operations.

And, further, that all statements made herein based on our knowledge are true and that all statements made on information and belief are believed to be true, and that we are aware that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001), and may jeopardize the validity of this application, document, or patent issuing therefrom.

S Nagesh Dated: 5-13-2009

Dr. Nagesh Sonti

APPENDIX B

homologous

One entry found.

On Off

Main Entry: **ho·mol·o·gous**
Pronunciation: \hō-'mä-lə-gəs, hə-\
Function: *adjective*
Etymology: Greek *homologos* agreeing, from *hom-* + *legein* to say — more at LEGEND
Date: 1660

1 a : having the same relative position, value, or structure: as (1) **:** exhibiting biological homology (2) **:** having the same or allelic genes with genetic loci usually arranged in the same order <*homologous* chromosomes> **b :** belonging to or consisting of a chemical series whose successive members have a regular difference in composition especially of one methylene group
2 : derived from or developed in response to organisms of the same species

Learn more about "homologous" and related topics at Britannica.com

See a map of "homologous" in the Visual Thesaurus

Pronunciation Symbols